

of the body is translucent, while from the anterior end a bar of rich reddish orange proceeds backward a short distance behind the epipodia. The tip of the tail again is flecked with reddish-brown pigment-grains. As Pallas first noticed, the muscular bands of the epipodia are so arranged as to give the organs the aspect of a file or rasp, as in *Cymbulia*, from their intimate decussation, and their mobility is remarkable. The animals mount gracefully from the bottom of the vessel and steer for the surface, or in a circle, the tips of the epipodia almost touching ventrally and again dorsally—just as a lithe swimmer would do in the erect position in the water by alternately touching the tips of his fingers in front and (if he were able) behind. In the case of *Clione*, however, the locomotive organ is a broad muscular wing on each side, the curves of which so strike the water as to cause the easy graceful motion so characteristic of the species.

The only Pteropod hitherto found on the eastern shores of Scotland is *Spiralis retroversus*, Flem., which occasionally occurs in vast numbers, as mentioned in the February number of this journal\*. It is equally abundant on the western shores. So rare are other forms that in our experience only one other species has been met with, viz. that termed by Dr. Gwyn Jeffreys *Clio pyramidata*, Browne, which had been carried by the Gulf-stream in August to a quiet bay in North Uist.

X.—*Some new Hypotrichous Infusoria from American Fresh Waters.* By ALFRED C. STOKES, M.D.

[Plate III.]

*Litonotus vermicularis*, sp. nov. (Pl. III. fig. 1.)

Body elongate, flattened, from fifteen to twenty times as long as broad, soft, flexible, and elastic, widest centrally, tapering thence to the rounded posterior extremity, and anteriorly to the subapical constriction; the frontal border obliquely rounded; ventral surface longitudinally striate; dorsal aspect ordinarily traversed by a narrow, longitudinally disposed, keel-like ridge; contractile vesicles multiple, thirty or more arranged in a single series near one lateral border, from eight to ten scattered and disposed near the opposite lateral margin;

\* 'Annals,' Feb. 1887, pp. 140-141.

nucleus moniliform, the nodules ovate, numerous; trichocysts abundant, most conspicuously developed as a dense, radiating series within the frontal border; anal aperture at some distance from the posterior extremity; endoplasm granular. Length of the extended mature body  $\frac{1}{60}$  to  $\frac{1}{30}$  inch.

*Hab.* Standing pond-water.

The largest and mature zooids are visible to the naked eye as fine white threads gliding through the water.

*Chilodon vorax*, sp. nov. (Pl. III. fig. 2.)

Body suboval, soft and flexible, twice and a half as long as broad, widest anteriorly, and curved towards the left-hand side, gradually tapering from the sinistral concavity to the rounded posterior extremity, the left-hand border slightly convex, the lip-like projection obtuse or rounded; cuticular surface longitudinally striate; nucleus elongate-ovate or subfusiform, located in the posterior body-half, usually near the right-hand lateral border; contractile vesicles multiple, small, spherical, scattered; an undulating line of cilia extending from the lip, beyond which it frequently projects, to the oral aperture; anal aperture dorsal, near the posterior extremity. Length of body  $\frac{1}{125}$  inch.

*Hab.* Fresh water, with *Oscillaria* and other algæ in early spring.

The rod-fascicle lining the pharyngeal passage is not only somewhat protrusible, as in the other members of the genus, and expansile and contractile at the distal extremity, but it is also freely movable within the body-sarcode around the margin of oral attachment as a centre. The Infusorians under observation fed voraciously on certain linear diatoms (probably a species of *Nitzschia*) with which the water teemed, the frustules often being considerably longer than the body of the animalcule in its normal condition, and, after being engulfed, consequently extending through the entire length of the Infusorian, and stretching the cuticular surface at both extremities until at these points the limiting membrane became the merest film. Before the process of engulfing was actually witnessed it was an interesting problem as to how the diatom became freed from the posterior region of the pharyngeal passage which extends almost to the centre of the body. The first supposition was that the posterior extremity of the body was sufficiently protruded under the pressure of the inflexible diatom to allow the latter to pass from the pharynx and then to glide forward, thus partially relieving the posterior pressure. This supposition was not correct. During the passage of the frustule, when the cuticular surface of the rear margin

of the body has reached its limit of extension, the pharyngeal tube, containing one end of the long diatom, suddenly and violently rotates forward until its normal position is completely reversed, and the diatom consequently slips out. The act is probably only to a certain extent voluntary, being effectually aided by the strong pressure from the extended cuticular surface, which tends to force the pharyngeal fascicle forward. This pressure is, however, not essential, as the pharyngeal tube is freely movable at the animalcule's will. I have seen it suddenly swing forward to free itself and as quickly swing back into its former and normal position. The latter act is evidently entirely voluntary\*. Reproduction is by oblique transverse fission. The animalcule was abundant in its habitat.

*Loxodes magnus*, sp. nov. (Pl. III. fig. 3.)

Body elongate, depressed, seven or eight times as long as broad, very soft, flexible, and elastic; narrowest anteriorly, the frontal border rounded and curved toward the left-hand side, the apical extremity terminating in a short beak-like extension; posterior extremity rounded; lateral margins somewhat convex; ventral surface flattened and longitudinally striate, the dorsal convex; adoral groove occupying about one seventh of the anterior lateral margin of the ventral surface, the membranous sickle-shaped lining conspicuous, the posterior portion long and narrow; refractive corpuscles numerous, arranged in a single longitudinal series near the right-hand lateral border; nuclei multiple, irregularly distributed; contractile vesicles apparently many and posteriorly located, but not positively identified; endoplasm vacuolar; colour brown; cilia and dorsal hispid setæ numerous, short, and fine. Length of extended body  $\frac{1}{10}$  inch.

*Hab.* Standing pond-water. Movements gliding, with frequent twisting and folding of the body.

This is readily distinguishable from the two previously recorded species by its great size and by the number of the marginal refringent corpuscles. The nuclei, or those nodules which I have considered to be the nuclei, are much paler in tint than the corpuscles just referred to, larger, and the centrally placed nucleolus in each is more finely granulate. A funiculus probably exists, although it was not positively observed. The posterior portion of the chitinous pharyngeal membrane often appears to be scarcely more than a brown filament, so narrow is it. Its general course is shown in the

\* See 'The Microscope,' vol. vi. p. 121.

figure, but it not rarely is more or less undulate. This Infusorian, like all the members of the genus thus far observed, is essentially a bottom-feeder, gliding over the submerged objects, the residual débris at the lowest parts of the shallow waters which it inhabits.

*ONYCHODROMOPSIS* (*Onychodromus*; ὄψις, form), gen. nov.

Animalcules free-swimming, soft and flexible, hypotrichous; frontal styles six, the anterior three largest and most conspicuous; marginal setæ uninterrupted; ventral styles in four longitudinal rows, the third series from the right-hand body-margin, or the second from the left-hand border, interrupted centrally; anal styles five.

This differs from Stein's *Onychodromus* chiefly on account of the soft, flexible, and uncurassed condition of the body. In the present form there is no trace of a dorsal shield or carapace, the body being quite soft and flexible, and furthermore bearing on the dorsal cuticular surface numerous short hispid setæ. Stein remarks of the form discovered by him and relegated to the genus *Onychodromus*, that the carapace is more indurated than that of *Stylonychia*, and less so than that of *Euplotes*, which is by no means the condition in the present form. The frontal styles, which, however, are of but secondary importance in generic diagnosis, are from sixteen to twenty-eight in number in *Onychodromus*, and the very important ventral setæ from fifteen to twenty-one; in *Onychodromopsis* the former are six in number, and the latter very numerous and arranged in a characteristic manner.

*Onychodromopsis flexilis*, sp. nov. (Pl. III. fig. 4.)

Body ovate or subelliptical, about three times as long as broad, somewhat narrowed anteriorly and slightly curved towards the left-hand side; marginal setæ longest and largest at the posterior extremity; ventral styles in four longitudinal rows, the second, counting from the left-hand body-margin, centrally interrupted, consisting of two or three anterior and two or three posterior elements; anal styles five, nearly marginal, often furcate or fimbriate, projecting beyond the posterior border; peristome about one third as long as the body, the inner or right-hand margin bearing a large and, in lateral view, conspicuous membrane; nucleus double, near the left-hand body-margin, but indifferently in the anterior or posterior body-half; contractile vesicle near the centre of the left-hand margin; dorsal hispid setæ short, inconspicuous, and abundant. Length of body  $\frac{2}{10}$  to  $\frac{1}{7}$  inch.

*Hab.* Standing pond-water, with *Lemnæ*.

*Holosticha vernalis*, sp. nov. (Pl. III. fig. 5.)

Body subelliptical, about four times as long as broad, very soft and flexible; both extremities rounded, the anterior lip short, crescentic; the peristome extending backward through about one third of the ventral surface, the right-hand margin ciliate, the adoral series on the posterior half of the left-hand border directed across the peristome-field towards the right hand, the anterior half directed towards the left hand; frontal styles five or six, scattered, the three anterior largest; ventral setæ forming two median rows, beginning in close proximity to the frontal styles; marginal setæ longest at the posterior border, those on the left-hand side gradually leaving the body-margin and approaching the peristome; anal styles from five to eight, usually fimbriated; contractile vesicle spherical, near the centre of the left-hand side; nucleus not observed; dorsal hispid setæ numerous. Length of body  $\frac{1}{140}$  inch.

*Hab.* Shallow pools in early spring, with algæ.

TACHYSOMA (*ταχὺς*, swift; *σῶμα*), gen. nov.

Animalcules free-swimming, soft, and flexible; frontal styles from eight to ten, the three anterior usually the largest; ventral styles five, scattered; marginal setæ at some distance from the lateral borders, interrupted on the posterior margin; anal styles five; caudal setæ none; dorsal hispid setæ usually numerous and conspicuous.

*Tachysoma agile*, sp. nov. (Pl. III. fig. 6.)

Body elongate oval, about four times as long as broad, both extremities evenly rounded; peristome-field arcuate, extending through about one fourth of the ventral surface, without a right-hand or reflected inner border; marginal setæ in close proximity to the five scattered ventral styles; anal styles five, large, often finely fimbriated, and with a tendency to form two groups, the two elements on the right-hand side usually extending obliquely towards the right; contractile vesicle near the centre of the left-hand body-margin, gibbously extending the region at complete diastole; nucleus double, each ovate nodule with an external subspherical nucleolus; dorsal hispid setæ long, fine, clothing the dorsal surface in several longitudinal rows. Length of body  $\frac{3}{75}$  inch.

*Hab.* Pond-water.

I was at first disposed to identify this with *Pleurotricha echinata* (C. & L.), S. K.; but that form, as suggested by Kent, probably belongs to another genus, being relegated to Stein's *Pleurotricha* with some doubt, as the supplementary

marginal setæ referred to are evidently luxuriantly developed dorsal hispid setæ. The absence of all trace of a supplementary ventral series of styles, together with the softness and flexibility of the body, exclude it from *Pleurotricha*, while the latter qualities and the absence of caudal setæ exclude it from *Stylonychia*, which it otherwise somewhat closely resembles; and, finally, the interruption of the marginal setæ at the posterior border refuses it admission among the species of *Oxytricha*, and from *Histrio* it is further excluded not only by the posterior interruption of the marginal setæ, but by its soft and elastic body. Its proper position is probably between *Oxytricha* and *Histrio*.

*Tachysoma mirabile*, sp. nov. (Pl. III. fig. 7.)

Body elliptical, less than four times as long as broad, the extremities equally rounded; frontal, ventral, and marginal styles essentially as in *T. agile*, but smaller and more setose; anal styles five, without tendency to form two groups; peristome-field arcuate, extending through about one fourth the length of the ventral surface, reflected or right-hand inner border none; contractile vesicle spherical, near the centre of the left-hand body-margin; nucleus single, elongate, subcentrally located, with an elongate, laterally attached nucleolus; endoplasm granular; dorsal hispid setæ long, most conspicuously developed near the posterior extremity. Length  $\frac{1}{45}$  inch.

*Hab.* Standing pond-water.

This form bears a close resemblance to the first-mentioned member of the genus, differing from it somewhat in size, but most conspicuously in the remarkable nucleus and nucleolus. The latter is so large and so closely resembles the nucleus that the two might be considered a uniquely arranged double nucleus, especially in certain individuals in which the nucleolus has become slightly separated from its lateral attachment. In none of the Hypotrichous Infusoria, so far as I am aware, has a similar nucleus been previously observed.

The movements of the animalcule are rapid and erratic. The body is frequently observed to be laterally curved, which region then becoming somewhat concave, the two extremities thus remotely approach each other. The Infusorian when in this condition often swims by rotation on the longitudinal axis.

*Tachysoma parvistylum*, sp. nov. (Pl. III. fig. 8.)

Body elongate-ovate, less than three times as long as broad, widest posteriorly, narrowed anteriorly to form a neck-like

region composing about one third the length of the entire body, the frontal lip small; locomotive styles small and short, the frontal ten in number, the anterior three largest; ventral styles five, the posterior two in close proximity to the anal, the three anterior arranged in a single longitudinal series; anal styles five, usually very flexible and active; marginal setæ scarcely projecting except posteriorly; right-hand margin of the peristome-field sigmoid; contractile vesicle spherical, near the centre of the left-hand body-margin; dorsal hispid setæ small and inconspicuous. Length of body  $\frac{1}{160}$  inch.

*Hab.* Shallow pools, in early spring. Movements active.

This agile colourless form is notable for its small styles; they are the most minute that I remember to have observed on any member of the *Hypotricha*.

*Oxytricha bifaria*, sp. nov. (Pl. III. fig. 9.)

Body oval, less than three times as long as broad, the right-hand lateral border convex, the left-hand margin flattened, the anterior extremity bearing a prominent, crescentic, lip-like projection, the posterior extremity obtusely pointed, its left-hand margin obliquely rounded; ventral styles five, scattered, the posterior one in close proximity to the anal styles, the latter five in number, forming two distinct and completely separated groups, the most posterior of which is composed of two large styles projecting beyond the body-margin, the anterior cluster being formed of three smaller elements placed above and to the left-hand side of the posterior group, and not extending beyond the margin of the body; peristome reaching to the centre of the ventral surface, the right-hand border ciliate and bearing a narrow membrane, a linear series of endoral cilia depending from the central region of the peristome-field; marginal setæ uninterrupted, longest and largest on the posterior extremity; nucleus double, the nodules large, ovate; dorsal hispid setæ short and inconspicuous. Length of body  $\frac{1}{160}$  inch.

*Hab.* An infusion of hay. Endoplasm granular, brownish and semiopaque. Movements rapid and erratic.

This Infusorian is quite variable in contour, being often evenly oval or elliptical, while other individuals appear with the frontal region somewhat curved towards the left-hand side. The essential characters, however, are constant, and by them the animalcule can readily be recognized as distinct from previously recorded members of the genus, the peculiar and distinguishing arrangement of the anal styles making it easily separable from other *Oxytrichæ*.

The most posterior of the five ventral styles is so intimately connected with the anterior group of anal uncini that careful scrutiny is usually needed to positively observe it. Its functions, however, its habit of curving forward, and its flexibility readily distinguish it from the anal cluster. The elements of the latter are rigid and unbending, only the one on the extreme right usually having great freedom of movement. The extremities of the two forming the posterior group are often fimbriated.

With this, as with *Oxytricha hymenostoma*, there is some appearance of a double peristomial membrane; but it is not conspicuous nor even very distinct.

*Oxytricha hymenostoma*, sp. nov. (Pl. III. fig. 10.)

Body subelliptical, soft and flexible, about twice and a half as long as broad, both extremities rounded, the left-hand region of the frontal border somewhat oblique, the left-hand body-margin slightly concave anteriorly; lip short, crescentic; frontal styles five unciniate and three setose; ventral styles five—two near the apex of the peristome-field, one central, two near the anal styles; the latter five in number, the three on the right-hand side usually projecting beyond the body; marginal setæ continuous, larger and longer on the posterior border; peristome extending to the centre of the ventral surface, the right-hand margin ciliated and bearing apparently two membranes of unequal width, the left-hand border furnished with a series of very fine paroral cilia; nuclei two, ovate; contractile vesicle spherical, near the centre of the left-hand border. Length of body  $\frac{3}{30}$  to  $\frac{2}{25}$  inch.

*Hab.* Hay-infusion. Movements rapid.

The appearance of two peristomial membranes is very distinct, and has been observed in all the numerous individuals examined. Their presence is unique, so far as the *Oxytricha* are concerned, and my impression is that such an addition to the not uncommon single membrane has not been previously recorded with any other member of the Hypotricha.

*Oxytricha acuminata*, sp. nov. (Pl. III. fig. 11.)

Body elongate-lanceolate, soft, flexible, and posteriorly somewhat extensile, about six times as long as broad when extended, the frontal border rounded and projecting as a soft, flexible, prominent lower lip; posterior extremity pointed, tapering; frontal styles eight or ten; ventral uncini five—three anteriorly placed, two near the five anal styles, the



latter scarcely projecting beyond the lateral borders, remote from the posterior extremity; marginal setæ uninterrupted, projecting beyond the body posteriorly only; peristome-field extending through about one fifth the ventral surface, the right-hand border ciliated and bearing an undulating membrane; contractile vesicle occasionally double, one situated near the centre of the left-hand body-margin, the other smaller and placed near the apical extremity of the peristome-field; nuclei multiple (usually four), the nodules ovate, each commonly with an externally attached nucleolus; dorsal hispid setæ long, arranged in about six longitudinal series; endoplasm granular. Length of body  $\frac{1}{225}$  to  $\frac{1}{150}$  inch.

*Hab.* Pond-water, with algæ. Movements rapid and erratic.

*Oxytricha caudata*, sp. nov. (Pl. III. fig. 12.)

Body elongate-ovate, soft and flexible, five or six times as long as broad, the anterior border obliquely rounded and slightly curved toward the left-hand side, posteriorly tapering to the conspicuous, attenuate, pointed, and somewhat retractile tail-like extremity; peristome from one fifth to one sixth as long as the body, the right-hand margin bearing an undulating membrane, the seven or eight adoral cilia bordering the anterior extremity large and setose, radiating when quiescent; frontal styles five, uncinata, with three smaller supplementary setæ; ventral styles five, three anteriorly and two posteriorly placed; caudal styles five, remote from the posterior extremity; marginal setæ uninterrupted, occasionally fimbriated, projecting posteriorly only; nuclei two, ovate, near the left-hand body-margin; the single spherical contractile vesicle situated between the nodules, in close proximity with the left-hand body-margin; hispid setæ forming several longitudinal dorsal rows, prominently projecting laterally. Length of body  $\frac{1}{100}$  to  $\frac{1}{120}$  inch.

*Hab.* Standing pond-water, with *Lemna*.

The large, almost uncinata, adoral cilia bordering the frontal region are, when the animalcule is quiescent, to all appearance rigidly extended. They then bear a resemblance to the same appendages so abnormally developed in *Actinotricha*. This Infusorian's movements are rapid, with frequent rather prolonged intervals of rest. So far as I am aware there is no other species of the genus with the attenuate and somewhat retractile tail-like extremity. The species is readily recognizable by these characteristics alone.

*Histrio inquietus*, sp. nov. (Pl. III. fig. 13.)

Body elongate-obovate, about three times as long as broad, the extremities rounded; marginal setæ uninterrupted; anal styles five, occasionally six, the extremities often finely fimbriated; peristome-field obovate, capacious, slightly curved towards the left-hand side, the right-hand margin ciliate and bearing an undulating membrane continued around the anterior border; nuclei two, ovate; dorsal hispid setæ present. Length of body  $\frac{1}{270}$  inch.

*Hab.* Standing pond-water, with *Lemna*. Movements rapid.

*Histrio complanatus*, sp. nov. (Pl. III. fig. 14.)

Body subelliptical, much depressed, twice as long as broad, the posterior extremity obscurely pointed, the anterior evenly rounded; frontal lip crescentic, conspicuous; peristome-field extending to near the centre of the ventral surface, the right-hand margin ciliated and bearing a membrane; frontal styles eight, five uncinatæ, with three smaller and setose; ventral styles five, one central, with two anteriorly and two posteriorly placed; anal styles five, the three on the right-hand side alone projecting beyond the body-margin; marginal setæ uninterrupted, longest and largest posteriorly; nuclei two, ovate; contractile vesicle spherical, situated near the centre of the left-hand border of the dorsal surface. Length of body  $\frac{1}{320}$  inch. Dorsal hispid setæ short and inconspicuous.

*Hab.* Shallow pools in early spring.

The position of the contractile vesicle beneath the cuticular surface of the dorsum is well marked, and the enclosed fluid is evidently expelled through that surface.

As in most of the Hypotricha possessing what has been called the upper lip, this part is really not a continuation of the dorsum, but more nearly of the ventral surface, and the adoral cilia lie above the projection until they leave the anterior border to pass to the left-hand margin of the peristome-field. This structural arrangement holds true in a majority of the lip-bearing Hypotricha, I believe in all.

*Euplotes variabilis*, sp. nov. (Pl. III. fig. 15.)

Body elongate-obovate, nearly twice as long as broad, frontal border truncate; the lip prominent, crescentic; right-hand side of the posterior extremity obliquely truncate or somewhat concave, the left-hand side of that border rounded;

right- and left-hand body-margins usually convex, occasionally flattened and nearly parallel, or slightly concave; dorsal surface minutely roughened, not carinate or furrowed; peristome-field capacious, the posterior extremity of the right-hand border ciliate, the anterior extremity deeply excavate, disposed to be helicoidal; frontal styles six, long; ventral styles three; the two right-hand caudal setæ multifid, the two on the left-hand side simple; anal and frontal styles often fimbriate; nucleus very long, band-shaped. Length of carapace  $\frac{1}{160}$  inch.

*Hab.* Standing pond-water, with *Anacharis*.

The adoral cilia may here be divided into two groups according to the direction of their free extremities, those on the truncate frontal border being directed outwards from that margin, while those on the left-hand side of the peristome-field are habitually vibrated and directed across and above that capacious excavation. The change of position takes place suddenly and is somewhat conspicuous.

The helicoidal flexure of the anterior portion of the peristome-field is variable. At times it is deep and conspicuous; in other individuals it is only a slight notch, while in others again it may appear only as an irregular depression.

#### EXPLANATION OF PLATE III.

- Fig.* 1. *Litonotus vermicularis*,  $\times 190$ .  
*Fig.* 2. *Chilodon vorax*,  $\times 138$ .  
*Fig.* 3. *Loxodes magnus*,  $\times 120$ .  
*Fig.* 4. *Onychodromopsis flexilis*,  $\times 280$ .  
*Fig.* 5. *Holosticha vernalis*,  $\times 210$ .  
*Fig.* 6. *Tachysoma agile*,  $\times 300$ .  
*Fig.* 7. *Tachysoma mirabile*,  $\times 415$ .  
*Fig.* 8. *Tachysoma parvistylum*,  $\times 360$ .  
*Fig.* 9. *Oxytricha bifaria*,  $\times 256$ .  
*Fig.* 10. *Oxytricha hymenostoma*,  $\times 350$ .  
*Fig.* 11. *Oxytricha acuminata*,  $\times 300$ .  
*Fig.* 12. *Oxytricha caudata*,  $\times 360$ .  
*Fig.* 13. *Histrio inquietus*,  $\times 490$ .  
*Fig.* 14. *Histrio complanatus*,  $\times 256$ .  
*Fig.* 15. *Euplotes variabilis*,  $\times 160$ .

#### XI.—*Descriptions of new Species of Heterocerous Lepidoptera (Pyralites) from the Solomon Islands.* By ARTHUR G. BUTLER, F.L.S., F.Z.S., &c.

THE following species, collected by Mr. C. M. Woodford, appear to be new to science.